SUMMARY OF RESEARCH
ON
INTERACTIVE DISTANCE EDUCATION

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Paradoxically, interactive distance education or "live teacher supported distance learning" (University of Aberdeen, 1996; page 11 attached) may produce deeper levels of communication (Neal, 1997; page 14 attached), promote more personalized instruction (Gardner, 1999; page 10 attached), create stronger student relationships (Boznik, 1996; page 12 attached), and result in higher academic performance (Schutte, 1998; page 15 attached) than traditional distance education or on-campus higher education.

INCREASED COMMUNICATION

Elite universities such as Harvard University, Stanford University, and University of Oxford use the following "21" Century communications" (Cotton, 1996, page 15 attached) in their interactive distance education classes:

- "Video-based conferencing"
- Chat/Internet discussions
- Message boards
- "Audio/video streaming"
- 64 simultaneous online discussions between students and teachers"
- "Electronic distribution of hand-outs and notes"
- E-mail (see pages 3 and 4 attached).

Private businesses such as BayNetworks, 3Com, Lockheed, and NCR Corp. for example (Parker, 1998; Mottl, 2000; Berry, 1999; pages 5,11, 14, and 15 attached) utilize new methods of electronic communication in their "corporate university" distance learning classes:

- Interactive television
- "instructor-led online classes in real time" *(Post-Standard Syracuse,* 1998; Cortez, 1998, Cobine. 1997; pages 12, 14, and 15 attached)

PERSONALIZED INSTRUCTION

Traditional distance education (correspondence courses, audio or videotaped lectures, and telecourses) is now augmented by "interactivity" or "personalized coaching or tutoring - which in the past was only available to the richest." (Rudgers U; Bludnicki, 1998; Gardner, 1999; Dodge, 1996; *Daily London Telegraph*, 1998; pages 8,10,3, and 4 attached).

STRONGER STUDENT RELATIONSHIPS

Students often develop stronger relationships with other students in interactive distance education classes than in traditional distance education or on-campus classes (Boznik, 1996; Neal, 1997; pages 12 and 14 attached).

HIGHER ACADEMIC PERFORMANCE

Although research about distance education effectiveness traditionally has shown 66 no significant difference" in student performance compared to student performance in traditional education (McAlpin, 1997; Clarke, 1999; Navarro & Shoemaker, 1999; Smeaton & Keough, 1999; page 8 attached), new research demonstrates higher student performance in interactive distance education than in traditional educational settings (Morrissey, 1998; Schutte, 1998; Despain, 1997; pages 15 and 16 attached).

CONCLUSION

During the past five years, empirical research and observational findings from case studies indicate that interactive distance education techniques may deepen class communication, personalize instruction, strengthen student relationships, and improve academic performance when compared to traditional distance education or on-campus education.

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INTERACTIVE Distance Education

Constructivism in Interactive Distance Education

"The goal of a constructivist learning environment is not the accurate transfer of content from the instructor to the learner. Instead, the learner is given tasks and opportunities, information resources and support, and is encouraged to construct their own version of the content, subject to revision through feedback. Many paths through the lesson are allowed and collaboration with other learners is stressed over lonely individual learning. A constructivist use of technology presents information to the learner in multiple forms from multiple sources and invites the learner to make sense of it.

The learner can acquire the information needed from several sources via the computer, and from off-line sources including his or her own prior experience, from information gathered while collaborating with other learners, and from references and other sources of expertise found somewhere far away from the computer screen.

In general, a constructivist approach is more learner-focused and less teacher focused. The emphasis is on making a set of tasks and resources available to learners, and creating an environment in which the learners can actively create their own meaning in that context, rather than to passively absorb knowledge structures created by the instructor. In this approach, the instructor's role moves toward being a coach and orchestrator of resources, and moves away from being the sole source of information. The emphasis is on case studies, problem solving, and the creation of meaning.

In the last two years, a new technology has grown enormously in importance and accessibility. This technology, the World Wide Web, lends itself beautifully to constructivist, active learning." Dodge, B. (1996) Distance learning on the World Wide Web, published in Brandon, B. et al, *Computer Trainer's Personal Trainer's Guide, Que Education & Training.*

Pioneers in Interactive Distance Education

Harvard University, Stanford University, and the University of Oxford are three examples of elite universities pioneering this new kind of distance education: interactive distance learning.

Harvard University offered the first "cybercourse" in the Law School's history, "Privacy in Cyberspace," in its spring term 1998 and had an enrollment of 1,000 students from 40 countries. *(Virtual University Gazette,* May 1998, http://www.geteducated.com Harvard's Beckman Center "offers participants around the world the opportunity to study law-oriented topics using the time-honored Socratic method with a twist - all curricular activity takes place on the Internet. Students will learn and interact with professors, teaching fellows, and other students separated in time and space through the use of message boards, chat, audio/visual aids, and e-mail." http://cyber.law.harvard.edu/online/

Stanford University offers state-of-the-art engineering and computer science courses online. Over 500 students enrolled in these courses during fall of 1997. Stanford is the "first university, through Stanford Online, to incorporate video with audio, text, and graphics in its distance learning offerings. Stanford Online also allows students to ask

questions or otherwise interact with the instructor, teaching assistant, and/or other students asynchronously from their desktop computer." An electrical engineering master's degree is available entirely online through "audio/video streaming with synchronized slide shows, the electronic distribution of class handouts and notes and simultaneous online discussions between students and teachers." Levander, M. (1998) Stanford offers engineering master's on Internet, *Mercury News.* http://stanford-online.stanford.edu

University of Oxford http://www.tall.ox.ac.uk/computing offers a two-year undergraduate certificate in computing over the Internet and is planning to offer bachelor's degrees entirely at a distance in the future. According to Geoffrey Thomas, director of Oxford's Department for Continuing Education, Oxford's classes are "designed around a completely new concept of online tutorial support that for the first time brings the Oxford tutorial within the reach of the distance learner. Special tutors will supervise studies using e-mail, Internet discussions and voice-based conferencing." *(USA Today*, July 20, 1998) Unlike many American online institutions, Oxford is seeking to "intensify" the personal touch in its online education. *(Daily London Telegraph,* May 28, 1998)

Related Disciplines Utilizing Interactive Technology at a Distance

Telemedicine: "East Carolina University (ECU) began conducting telemedicine consultations in 1992 and to date has completed over 2,350 consultations in 32 different specialties of medicine over REACH-TV network. Currently, 38 ECU physicians provide medical care to patients referred by 55 rural healthcare providers." *(Federal Documents Clearing House June 5, 1998)* "Telemedicine also has the potential to improve the delivery of health care in America by bringing a wider range of services such as radiology, mental health services and dermatology to underserved communities and individuals in both urban and rural areas." *(Telemedicine Report to Congress,* January 31, 1997) In the U.S., seventy psychiatry programs offer therapy for patients by video teleconferencing. *(New York Times,* April 9, 1998)

Definition of "Distance Learning" by the USDLA (U.S. Distance Learning Association)

http://www.usdla.org/transferstuff/dI.html

"Distance Learning is the application of technology of electronic means to education in all areas: K-12, Higher Education, Continuing Education, Corporate Training, and Military and Government Training, Telemedicine, and those devoted to the pursuit of lifelong learning."

Users of Distance Education

"Two types of users have an interest in distance learning:

1) Industry and government agencies seeking to educate their employees and
2) Colleges and universities seeking to expand their outreach to businesses, industries, and elementary and secondary school systems, and service professions..." Connor, P.E. (1995). Distance learning: Link to a worldwide community, *Technical Co.,* v42 n4 p 646.

Industry Users

1) IT Industry - Need for Information Technology Training: “60% of all new jobs created today require high level technological skills, and by 2015 the number will be 90%.” (Benhamou, Chairman/CEO of 3Com, CEO Technology Workshop, August 7,1998)

2) Companies: "According to an Omnitech 1997 survey of Fortune 1000 companies, one-half of corporate training will be conducted online through technology-assisted methods such as computer-based and web-based training as well as virtual classrooms." Macromedia debuts live learning center, PR Newswire, June l6, 1998. By August 1998, “89% of corporations” were in the “process of implementing on-line delivery of learning and training.” Corporations implementing on-line learning struggle with technology, IT departments and creativity, *Business Wire*, August 24, 1998.

   "Faced with retraining 50 million American workers, corporate America is using distance learning for all aspects of training both internally and externally." (USDLA, http://www.usdla.org/transferstuff/dI.html

   . . . in the next decade, 75% of current workers will need significant retraining. More than half of the new jobs in the future will require higher learning and training ... Many current higher education practices are ill-adapted to the needs of employers and adult learners. They pose barriers to participation, including a lack of flexibility in calendar and scheduling, academic content, modes of instruction and availability of learning services, among others." Williams, C. (1998) Report points out value of lifelong learning, *Dallas Business Journal.*

   "By the year 2000, there will be a 13% compound annual growth rate for the amount companies spend on distance learning programs, predicts Judy Weller, an analyst at Gartner Group, Inc. in Stamford, Connecticut ... [At 3Com], "plans are also underway to put streaming video on every desktop. 'As recently as 18 months ago, IS people said you can't do it [due to technical limitations],' explains Bob Roman, director of business development. 'But the Web forces people to think differently. Now you can share information in a more dynamic, real-time method.'
   ... Bay Networks uses the Java-based application to conduct instructor-led, online classes in real time. Users can view slides, click a control to raise their hand and ask questions, talk via text chat and take quizzes as they would in a (real' classroom." Parker, E. (1998) Distance, *Computerworld* v32 n2l pS23.

   "Corporations will continue to need traditional universities to carry out basic education and research. Nevertheless, corporations will increasingly take on teaching themselves. Employee education is growing from 50 to 100% faster than academia." Vines, D., Thorpe, B., and Threlkeld, R. (1995?) California higher education extends its reach, *On the Horizon On-Line*, v5 Issue 6.

3) Corporate Universities: "About 1,600 companies (up from 400 in 1988) have corporate central education and training organizations." (Corporate University Xchange) Companies going to school, *USA Today*, July 13,1998.

"Motorola University, based on a campus in Schaumburg and a part of the U.S. high-tech company from which it takes its name, now has more than 400 full-time faculty, with another 800 part-time contract teachers. It teaches over 100,000 students a year, 22% of whom come from outside the company." Jeanne Mositer, president of Corporate University Xchange, said, 'As the funding model changes to be more self-funded, these universities are going to brand what they are doing and use their significant resources to go to the external market. At that point they are a significant threat [to universities].'" Motorola leads the way in the corporate university sector, *Financial Times*, June 18, 1998.

Education Users

Taken from the National Center for Education Statistics, "Statistical Analysis Report: Distance Education in Higher Ed. Institutions"1997 http://nces.ed.gov/pubs98/distance/indes.html

- **Number of Colleges and Universities Offering DE Courses "In Fall 1995, 58% of public two-year and 62% of public four-year institutions"**

- **Delivery Methods**
  Distance education courses were delivered by two-way interactive video at 57%, and by one-way prerecorded video at 52% of the institutions offering D.E. courses Fall 1995. About ¼ of the institutions used two-way audio with one-way video, and computer-based technologies other than two-way online interactions during instruction (e.g., the Internet).

- **Numbers of Students Enrolled in Traditional and D.E.**
  In Fall 1994, there were approximately 14.3 million students enrolled in higher Education institutions (U. S. Department of Education, National Center for Education Statistics). . . an estimated 753,640 students enrolled in d.e. courses in academic year 94-95.

- **Increasing Interactive Distance Education**
  About ¾ of the institutions that currently offer or plan to offer d.e. courses plan to start or increase their use of two-way interactive video, two-way online (computer-based) interactions during instruction, and other computer-based technologies to deliver their d.e. courses in the next three years. [by 20001

- **Goals of Colleges and Universities Offering Distance Education**
  - Increasing student access (important goal for most d.e. programs)
  - Making courses available at convenient locations (very important by 82%)
  - Increasing institution's access to new audiences (very important by 64%)
  - Reducing time constraints for course-taking (very important by 63%)
  - Increasing the institution's enrollments (very important by 54%)
  - Making educational opportunities more affordable (very important by 50%)"

Distance Education Market

1) Military Personnel (USDE)
2) Prison Inmates (USDE)
3) Native Americans/Alaskan Natives on tribal lands (USDE)
4) Females/Homemakers - "Sixty-six percent of the adult distance education market is female, and 80% of them have children." *(USA Today,* November 16, 1998) "Curt McCarty, coordinator of distance education at San Diego City College, surveyed distance learners after the spring semester and determined that their average age was 31 and that 72 percent were female." Moran, C. (1998) Going online: The old correspondence course has gone high-tech, *San Diego Union-Tribune.*
5) Professionals - "According to a new survey of college-educated workers aged 30-55 by George Mason University and the Potomac Knowledge Way, 'Only 16% of those surveyed want to take courses in a conventional college setting. Nearly one-half (48%) want to combine online resources, video, and distancelearning." College grads re-think majors, career choices, *Business Wire,* June 8, 1998.
6) Non-traditional students seeking a college degree and working full-time - Over 58% of students enrolled in college in the U.S. are between the ages of 22 to 64. (USDE)
7) College freshman who cannot afford to pay out-of-state tuition, students from rural areas, potential students from foreign countries - "Eighty percent of all freshmen in fall 1996 who had graduated from high school in the previous year attended colleges in their home states." (USDE)
8) Projected College Enrollment 2008 - 16,083,000 students (USDE) In 1999, there were Ill million distance learning students and 13 million in traditional higher education." (Dr. Frank Rhodes, Professor Emeritus of Cornell University and Trustee, of the AGBUC, Address to the Association of Governing Boards of Universities and Colleges, 1999)
9) Students who cannot afford to study and also pay for transportation or other on-site costs: ". . . If a student studies by distance they say 'I don't need to pay for child care or gasoline expenses.' Economics are real issues." (Lessons learned at Assiniboine Community College, *Post Secondary Committee on Learning Technologies,* December 10, 1997)
10) Disabled - "Among the 1.6 million first-time, full-time freshmen enrolled at 3,100 institutions of higher education in the U.S. in 1998 ... some 154,520, or 9.4 percent, had some kind of disability, says a new study by the American Council on Education. In 1978, by contrast, less than 3 percent of freshmen reported having a disability." Learning-disabled flocking to colleges, *Deseret News,* March 21, 2000
11) Special populations - Individuals suffering from chronic illnesses or emotional disorders. In an informal survey of 50 students in my learning classes from two colleges (1999-2000), only 10% listed academic problems as "barriers to learning." Over fifty percent of students cited emotional problems such as "fear, anxiety, perfectionism, eating disorders, obsessive-compulsive disorder, depression, stress, or alcohol and drug addiction" as "barriers to learning in college." (Distance education may alleviate fear, anxiety, and stress.)

Inadequacy of Distance Education in the Past

"The general model of higher education is that of the teacher lecturing to students in the classroom. This 20th century model of mass higher education where teachers and students interact in the classroom has supplanted the 19th century model of personal education as embodied in the Oxford tutorial tradition." Bludnicki, M. (1998) Supporting virtual learning for adult students, *THE Journal (Technological Horizons in Education)* v25 nll p73.

". . . For almost a century correspondence courses have used mailed print materials to enable students to study at home... Videotaped lectures have been available for two decades. What is new about distance education today is the increasing 'interactivity' afforded students and teachers by electronic developments such as the Internet, WWW, and E-mail, as well as two-way teleconferencing, compressed video and satellite transmissions." Rutgers U http://www.scils.rutgers.edu/de/deabout.html

"Our present university structure dates back to the Middle Ages. We collect professors and students in one 'community of scholars,' frequently in relative isolation. Our world is of course dramatically different from that in which universities were born. One response by higher education is using technology to overcome space and time limitations. This may well become the primary model of post-secondary education. Again, we as faculty need to be involved in the process. If we do not, others, less concerned about knowledge and learning, will shape it for us." Eisenberg, Daniel, Assistant to the Dean of Arts and Sciences for Information Technology, Northern Arizona University. (1997) College faculty and distance education, *Virtual University Journal*, http://www.openhouse.org.uk/viMaluniversity-press/vuj

"No Significant Difference Phenomenon" http://cuda.teleducation.nb.ci/nosignificantdifference

"Data analysis revealed that delivery strategy does not influence the academic performance of on-line and face-to-face students." McAlpin. V.F. (1997) The effects of selected factors on academic performance of on-line and face-to-face students, Dissertation, North Carolina State University.

"There were no significant differences in the test scores for the classes measured ... same class, same instructor, same audience, same exam - just different format." Clarke, D. (1999) Getting results with distance education, University of California at Santa Cruz.

"The findings appear to provide evidence that cyberlearning can be as effective as traditional classroom learning." Navarro, P. & Shoemaker, J. (1999). The power of cyberlearning: An empirical test, *Journal of Computing in Higher Education.*

"The results in this paper have shown that when virtual lectures are used in place of traditional delivery methods there is no significant difference in attainment level as measured by end of year examination marks." Smeaton, A. & Keogh, G. (1999) An analysis of the use of virtual delivery of undergraduate lectures, *Computers and Education*, v32 p83.

Concerns about Distance Education

From IT Managers:

"An InformationWeek Research survey of 200 IT managers shows that most prefer traditional training methods." Violino, B. (1998) Web training catches on, *Information Week)*

From Employers:

- Kelvin Taketa, president and CEO, Hawaii Community Foundation, "'I think in the beginning, employers will look at an online degree with a lot of skepticism.'"
- David R. Daugherty, principal, Masa Fujioka & Associates, an environmental firm, "'That would be too impersonal. It's important to have good communication skills when dealing with people day in and day out. There's no substitute for that.'"
- R. On-Lawson, assistant vice president, Pacific Century Trust, "'It would be credible at a certain level. Earning a master's degree online may prove favorable if the [employee's] undergraduate degree was obtained at a real university. Sometimes physically going to class is a waste of time.'"
- Frank Fukunaga, acting director, High Technology Development Corporation, "'. . . I believe [employees] need to develop good social skills, which can be attained by a university. Although the Internet provides an effective tool for distance learning, there still needs to be some kind of environment that provides for social interaction and team building.'" Campos, F. (1998) Employers value the social interaction of a campus classroom setting, *Pacific Business News.*

From Distance Education Faculty or Administrators:

"Johnson, the EKU [Eastern Kentucky University] professor, said he had to come up with new ways to run his satellite class since he can't see the students. 'We can't just do a talking head,' he said. 11 probably spend three times as long preparing for this class as I would for a traditional one.'" Muhs, A. (1996) The changing face of higher education: Universities going high-tech to take classes to *students, Knight-Ridder/Tribune News Service.*

Weiss (city librarian and program director of PSVU - Palm Springs Virtual University): "'If I had to send my kids to college, I still think the best model is an actual 'bricks and mortar' college campus. What we're trying to do is create a model that works in an

environment away from the major universities that is as close to that quality as possible. We understand that it is not quite as good. But it's still better than the Internet model. There has to be some testing mechanism, some evaluation mechanism, and I don't think the Internet offers that ... Public libraries are being threatened more than any other educational institution in our society by the advent of technology. Much of what we do is available online 24 hours a day now ... so if we don't redefine the public library's relevance to the community, there will be a time when people say 'We can't afford it.' And that's unacceptable." Levinson, M. (1998) Creating a muniversity: Palm Spring goes virtual, *American Libraries.*

From Faculty:

"York University (YU) in Toronto, Ontario ... Some faculty believed that the use of technologies such as the Internet, WWW and CD-ROM undermined their autonomy. Others were unconvinced of the educational utility of such technologies, arguing that they reduce human interaction, hinder critical thought and waste time. Many faculty worried about losing their jobs because of technological innovations." Young, J. (1997) Canadian University promises it won't require professors to use technology, *The Chronicle of Higher Education,* v44 n6 pA28.

"Professors' complaints focused on the extra amount of time teaching a distance learning class, primarily due to voluminous email exchanges, and their feeling that not all courses, especially those that require hands-on training, are appropriate for the distance learning format. In addition, concerns have been voiced that intellectual property rights are less clear-cut in cases where a course's syllabus and lecture notes are placed on the Web by the professor with the assistance of university software designers." Florida Gulf Coast University, *Wall Street Journal,* July 15, 1998.

History Professor Gregory: "'I doubt that many 19- and 20-yearolds are going to sit at their kitchen tables and download courses,' he says. A university education, he adds, is more than taking courses; it's the social experience of encountering new ideas and new people. 'You can't do that on the Internet, and we would be cheating a generation if we tried to substitute some type of techno education for a campus education.'" Woody, T. (1998) Academics rebel against an online future, *CNN Interactive.*

"Finally, with respect to technology, I find myself squarely in the middle: the new technologies hold tremendous promise, but they must be seen as means rather than ends ... In the future... education will be organized largely around the computer... computers will permit a degree of individualization - personalized coaching or tutoring - which in the past was only available to the richest." Gardner,Howard. (1999) *The Disciplined Mind*

Interactive Distance Education

"With the spread of interactive technologies such as audio or video conferencing, a new type of distance education - live teacher supported distance learning - is emerging. The experience of using audio conferencing at the University of Aberdeen [Canada] suggests that the benefits of distance learning can be preserved while the problems of traditional distance courses can be mitigated." The potential of live teacher supported distance learning: A case study of the use of audio conferencing at the University of Aberdeen, *Studies in Higher Education*, October 1996.

"One of the debates about on-line learning is which method - synchronous, or real time learning; or asynchronous learning - is better. Those who favor asynchronous methods, in which students download the material at a time most convenient to them, contend real-time learning doesn't solve the time problems that hold many back from pursuing education. Yet those who favor real-time learning say it's necessary to have the students together, that it's more like a traditional classroom's free flow of ideas. . ." Carroll, G. (1996) Virtual U: Students earning degrees on line, *Knight-Ridder/Tribune News Service, p5l4.*

"In the traditional classroom, the potential for learner-instructor and learner-learner interaction is very high, but instructors have largely ignored this mandate for change and continue to employ the lecture mode as the predominant method of instruction. In the virtual classroom, on the other hand, technology supports collaborative learning, heterogeneous groupings, problem-solving and higher order thinking skills - educational processes that a lecture format cannot facilitate." Van Dusen, G. (1997) The virtual campus: Technology and reform in higher education, *ERIC Digest.*

"Many teachers feel the opportunities offered by distance education outweigh the obstacles. In fact, instructors often comment that the focused preparation required by distance teaching improves their overall teaching and empathy for their students." ("Distance Education at a Glance, Guide #2, October 1995, Engineering Outreach, College of Engineering, University of Idaho, http://www.uidaho.edu/evo/dist2.html

"More than half (55%) of respondents to *Information Week* Research's survey of 300 IT executives rank distance learning as a key business priority this year. It's the only way to bring new and current employees up to speed on new technologies without spending a lot of time and money in the process ... Without a strong interactive element, e-learning's effectiveness is questionable, training specialists say ... Lockheed's Vicek has dismissed satellite courses and videoconferencing, citing a lack of interactivity and describing them as nothing more than a 'college lecture format' . . . Engaging students and keeping them involved in the classroom are crucial to successful higher education, Vicek says . . . The obstacles in replicating the traditional environment online can't be underestimated, and there are discrepancies in measuring its effectiveness, adds Elliot Masie, president of the Masie Center, a Saratoga Springs, N.Y., think tank focused on learning and technology ... 'We've seen a lot of evidence and good examples that [E-learning] works, but we're at the beginning of experimentation and exploration with this training technology,' Masie says.'" http://www.informationweek.com/767/learn.htm Mottl, J. N. (2000) Learn at a distance, *Information Week.*

Interactive Distance Education Case Studies

Lane and Ashley, professors: "'I finally figured out that I can get quite a bit of discussion if I turn myself out and put the camera on them [the students],' Lane said. 'I just let the students talk back and forth.' Ashley said, 'A lot of people think distance learning is an alienating experience. Here's evidence against that.' Ashley's students post their papers on the class Web site and are required to comment on one another's work. They also discuss a question every week online." New technologies, new hurdles, interactive video classes offer challenges to teachers and students but also offer all students a chance to participate, *The Post-Standard Syracuse, June 9, 1998.*

"In the spring of 1995 seven classes (six graduate, one undergraduate) were offered on the ICN (Iowa Communications Network) by the University of Northern Iowa ... All were taught by a different instructor ... All 168 students were surveyed; 103 responded ... 76% of the respondents were male; 23% female ... ranged in age from 21-57 ... only 24% of the students were taking their first class in this setting, with 19% taking their fourth or fifth ... Students taking an ICN class were asked to indicate how the setting influenced things like their attendance in class, asking and answering questions, and motivation to learn. For most actions the most common response was that the setting made 'no difference.' Our research on student perceptions of a course taken in two-way interactive video format provides insight into that experience ... The results provide evidence that the setting does not limit the instructor to a 'talking head' mode of teaching and that a variety of instructional methods can be used effectively ... Students appear to adjust to the setting and, for the most part, only a slight effect on their academic behaviors is indicated. The one result worthy of special comment is that the most frequent response to being asked about the likelihood of *developing a positive relationship with other students* was an indication that it was *more likely to occur in the interactive video setting* provided by ICN's fiber optics." Bozik, M. (1996) Student perceptions of a two-way interactive video class, *THE. Journal (Technological Horizons In Education Journal).*

"I find that I get to know my Internet students much better than my classroom students. Many are recuperating from surgery or are disabled. They aren't mobile enough to navigate stairs at college. They tell me that they love my class." Jerry Giles, Professor, Salt Lake Community College, February 2000.

"I have shifted to a learner-centered approach rather than an information-transfer approach ... The learners are located at many statewide locations as well as on the web ... They are also at many different levels, ages, competencies, backgrounds/cultures, ways/styles of learning and rates of learning metabolism ... It has meant a lot of work and rethinking what I do in the classroom ... And while there are endless complaints about technology by many who teach in traditional ways, I will never go back to those practices which I too engaged in for the earlier portion of the 48 years I have spent as a faculty person." DEOS - September 1, 1998, H. Guy Bensusan, Professor of Humanities and Religious Studies, Senior Faculty Associate for Interactive Instructional Television, Northern Arizona University.

"Abstract: Distance learning using two-way audio and visual interaction offers opportunities for personal interaction with and among students. Describes the experiences of a faculty member of the California State University (Chico, CA) who taught a human

geography course to students in California and Japan. Provides examples of student-centered assignments." Hardwick, S. (1997) Distance learning goes global: A faculty perspective, *Distance Education Report.*

"I developed and implemented a 'blended technology' distance education delivery system that used several types of technologies and a variety of instructional methods. Learners were able to work with interactive television, online/Internet discussions, and audioconferences, videotaped instructor presentations, a telecourse, printed materials and phone mail. The course was 'Educational Research,' a graduate level offering from a mid-sized regional university in Michigan ... Student achievement was very high for some objectives and about the same as face-to-face courses I had taught in the past for other objectives. The online/Internet discussion was excellent for developing higher-level thinking and interaction." DEOS, H. Major, June 5,1998, Distance Learning Dynamics.

"Gary Frederick, chairman of the Chemistry Department at BYU-Hawaii is currently using technology in his classroom. Rather than marking a blackboard, he shows color images projected from a computer. Occasionally, to illustrate a point, he uses computer technology to give his students a better idea of what is happening on a molecular level. 'We will take a picture of a molecule, then turn it slightly and take another picture,' he explained. The computer program then runs the pictures in rapid progression showing rotation ... Calling technology one of many teaching tools, Brother Frederick said the computer-aided lectures have helped to make some concept more understandable to students. 'The chemical world is also dynamic 3-D world,' he explained. 'A combination of computer graphics, molecular modeling software programs, and animation capabilities make it possible to more effectively show this dynamic, 3-D world. We find that our students simply enjoy the process of learning with these presentations.

[John D. Lamb] developed a program he calls 'Chem Tutor.' When students sign up for his class they buy a CD-ROM and a workbook ... Students can view 1,600 slides on Chem Tutor, study vocabulary words, and solve problems ... Last year he tried the program with an experimental section of his chemistry class. The students did slightly better than those studying chemistry without a computer. But most important, said [John] Lamb, the students who had the benefit of the computer program 'came away from the experience with a better attitude about chemistry and science.'" Dockstader, J. A. & Weaver, S.J. (1998) Chalk, blackboard becoming things of the past in LDS Church schools, *Church News.*

"Effectiveness of Distance Learning for Class Participants: Students found it valuable to hear the varied perspectives of students from other geographic regions and parts of the company. By the end of the class, students were surprised at how comfortable they felt with each other and the instructor; one student said that he felt 'the same comraderie' that he experienced at the end of a face-to-face class. The strength of the instructor-student and student-student relationships that developed during the class was an area in which distance learning proved more successful than anticipated. This was a valuable finding since students use classes as a way of meeting other employees, learning about what other groups do, and even finding their next internal job. In these classes the networking was further enhanced by the wide geographic distribution of each class (typically a mix of the U.S., Europe, and Asia/Pacific).

(continued) Many of the students found that they were able to use the technologies introduced during class as part of their work collaborations, thus increasing the value of the class to them.

The amount of time needed for the instructor to schedule class meetings, update materials on the Web site, and contact students was far greater than what was needed to set up and deliver an on-site class.

We found that the use of multiple technologies provided richer communication than any one technology alone. Each technology promoted a different type of interaction and used different senses. Students varied in their preferences for and comfort levels with the different communication mechanisms. There were also indications that each technology proved effective for different student learning styles. The use of the technologies proved, in itself, to be a valuable pedagogical experience.

The richness of face-to-face communication was exceeded in some respects by the use of multiple technologies. The students in distance learning classes got to know more fellow students well, rather than only the ones they were sitting near, and the instructor likewise got to know most students in the class well, not just the ones who talked to her during breaks. The strength of the relationships students formed with the other students and the instructor is largely attributed to the mix of technologies, each of which fostered varied personal communication styles and allowed people's personalities to be apparent.

From the instructor perspective, class preparations were much more time-consuming and the matching of class meeting to delivery technology much more complex than anticipated at the outset or than required for classroom delivery ... Despite the extra work, the classes were more fun, in many respects, than a face-to-face class, for the instructor." Neal, L. (1997). Virtual classrooms and communities, Proceedings of ACM GROUP '97 Conference, November 16-19, 1997, Phoenix, AZ.
http://www.lucent.com/cedi/group97.html

"A classroom of students in a southern Utah high school wished one of its teachers a happy holiday. But they had never seen him in person. He teaches their class from a technology center at Weber State University - hundreds of miles away. 'No group of students in a face-to-face class ever did that, so it was very personal and very warm,' [Health science professor] Gundy said, saying that this shows that technology doesn't have to be impersonal ... The anatomy and physiology course Gundy teaches is part of a statewide movement toward technology-delivered classes ... When lecturing with EDNET '. . . in the space of a few hours we can take [the students] into operating rooms and allow them to watch coronary artery bypass surgeries, cardiac catheterizations and those other types of procedures that they couldn't get into a hospital to see,' Gundy said. 'Instead of being the sage on the stage, which is what we have been,' Gundy said, 'we'll be the guide on the side.' He said this change is positive for students. 'They're not going to have a sage on the stage to teach them everything they need to know about life.'" Long-distance class gives teacher 'warm fuzzy,' *Deseret News,* January 5, 1998.

"NCR Corp. is yet another company that agrees Web-based training is valuable. Up until two years ago, 95 percent of NCR's training was delivered through the classroom in buildings located worldwide. Today, 10 percent of the $6.5 billion company's in-house training is Web-based, and 40 percent is delivered outside the traditional classroom setting, chiefly through interactive television, CD-ROM and the Web.

Dave Siefert, director of NCR University Virtual Learning, says the company offers 600 Web-based courses. . . He says a recent cost-benefit analysis of all types of technology-oriented training based on a survey of 288 employees showed that Web-based training delivered nine times the benefits versus the costs in terms of productivity and the quality of the experience." Berry, J. (1999) Web learning starts to pay off, *InternetWeek.*

"This summer, Chase taught five sections of Communications I 10 over rive different mediums to compare student learning in the traditional classroom vs. distance learning ... Chase taught 20 students each through classroom instruction, over the internet, via satellite, television broadcast and videotape checkout. Students used identical textbooks, and Chase used the same material to instruct each class ... Researchers are still compiling data, but Chase has drawn at least one anecdotal conclusion from his teaching marathon: 'Students at distance may be getting a better education, in the regard that they're reading the tests, answering the questions and actually having more interaction with the professor. It's a much more interactive environment than people realize ... It's the future of education,' Chase said, explaining distance education bashers are akin to people who summarily dismissed the worth of automobiles or airplanes. 'It's where we are.'" Cortez, M. (1998) SLCC class taught 5 ways in live and high-tech settings, *Deseret News.*

"Through independent study, students become doers, as well as thinkers. At some colleges, students now use computer networks to arrange their own education. For instance, in Vanderbilt University's 'asynchronous learning' program, students access lectures and assignments across a campus-computer network (Wyatt, 1997). In these online classes, students meet only for final exams ... Electronic mail, or e-mail, now extends letter writing. Through school computer networks, students now can correspond directly and instantaneously with distant students, as single partners, or as entire classrooms (Cotton, 1996) ... Meanwhile, in reading and writing these electronic messages, they rehearse 21s' century communications (Cotton, 1996).

Through collaborative study, students also learn cooperative attitudes. At Vanderbilt University, the online students, sending e-mail to one another, form small study groups (Wyatt, 1997). At Indiana University, for his philosophy class, President Myles Brand supplements study and discussion through a 'listserv,' or e-mail network limited to his students - he does so not only to make assignments and answer queries, but also to urge classmates to communicate outside class (Gress, 1997)." Cobine, G. R. (1997) Studying with the computer, *ERIC Digest.*

"Significant Difference Phenomenon" http://cuda.teleducation.nb.ca/significantdifference

"Results showed that case study groups with groupware significantly outperformed traditional face-to-face groups." Morrissey, C.A. (1998) The impact of the Internet on management education: What the research shows, Pepperdine University, http://horizon.unc.edu/TS/cases/I 998-06.asp

"Results indicate the virtual students scored an average of 20 points higher on the 100 point midterm and final exams ... All differences are highly significant." Schutte, J. G. (1998) Virtual teaching in higher education, California State University, Northridge, http://www.csun.edu/sociology/virexp.htm

"Results of the study suggested that: 1) students tend to learn more effectively/efficiently using the computer delivery system; 2) students who complete more exercises learn more (significant only for the computer group); 3) there is a time advantage to using the computer; 4) students who complete the exercises via computer have a more positive attitude towards the listening comprehension exercises, and yet a less positive attitude toward the delivery medium, when compared to their counterparts using the traditional format; 5) students in the computer group have a more positive attitude towards language learning in general." Despain, S. (1997) The effects of two delivery systems for the listening comprehension exercises on the language performance and attitude of beginning Spanish students, NCSU http://sasw.chass.ncsu.edu/fl/faculty/despain/abst

Impact of Technology on Higher Education

Dr. Frank Rhodes, Professor Emeritus of Cornell University and Trustee of the Association of Governing Boards of Universities and Colleges, Speech to the AGBUC, 1999:

"How, in a brief session, do we measure the magnitude of information technology? It is a major new threat to our colleges. It is a major new opportunity because it provides completely new access and new approaches in the dissemination of application of knowledge. It is a major new threat because we have been slow to use it, slow to modify it, slow to employ it.

The old pattern regarded knowledge and a degree as the goal. The new pattern sees competencies and skills as things to be transmitted. The old pattern was site-based; one campus, one place. The new pattern is unconstrained: any person, any study, any time, any place. The old pattern was a standardized curriculum, with limited choice. The new pattern is an individualized program with unlimited choice. The old pattern was a fixed calendar. The new pattern is infinitely flexible. The old pattern was faculty centered, faculty presented. The new pattern is student centered, student discovered. The old pattern was cost intensive. The new pattern is cost effective ...And the impact of all that? We still don't know. There are those who argue that this will affect training, but not education, but I wouldn't bet on it. The same was probably said for printed books when they were first developed.

Our monopoly of higher education is about to end. We are about to become a deregulated industry ...We had a monopoly, and we've enjoyed it for three and a half centuries...

We represent inherently conservative institutions ... We're superb at making revolutionary suggestions for change in other institutions; but being blind to the need for reform in those, we, ourselves, represent.

We must become more student-centered, much more student committed than we have been...

We have pretended for far too long on the campuses that because knowledge is priceless, anything goes. We don't have to take efficiency seriously. That day has gone. The public has become intolerant with the constant increase in costs on the traditional campus. We shall neglect efficiency at our peril."

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